01- Lead Article

Structure and Lining: A Review

By Jim Coddington and Christina Young

Historically, changes in the practice of structural conservation of paintings reflect the general thrust of change in conservation practice; slow and perhaps even methodical. Only occasionally can we identify landmark moments or events that have shifted the field. The 1974 Greenwich Lining Conference is one such event in the history of the conservation of paintings. The conference's nominal topic was lining, or the addition of a second fabric to the back of the original, a profound intervention on the work of art and thus a topic of the great importance then and now. The conference papers and discussions scrutinized then current practices in lining and the structural restoration of paintings as well as new approaches that were in development at the time.

Box start

Conference Proceedings were published in 2000, as:

Villers C., ed. 2004. Lining Paintings: Papers from the Greenwich Conference on Comparative Lining Techniques, *Archetype Publications*.

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What was manifestly clear in 1974 was that our understanding of the mechanics of paintings, their mechanisms of deterioration and other fundamental questions was limited. Paintings on canvas, or more generally on fabrics, are complex constructions of auxiliary support, support, preparatory layers, paint layers and coating layers - all of which interact dynamically. This is the basic mechanical model for paintings. Since then, research has given us a better understanding of the mechanics of how these painting materials react to the environment: that many stresses in the structure are induced by the hydroscopic response of the materials and that these stresses lead to distortions and cracks or tears in the layers. This basic engineering concept and model applies to understanding structural treatments, as they result in manipulating a complex system of interacting parts when visible signs of change lead us to consider a structural treatment for the painting; However, the mechanical models developed within the field of paintings conservation and the experimental methodologies used to date need refinement. At present, discrete parts of the physical structure and their interactions are better understood than the whole.

Forty plus years later it is useful to take stock once again of the current state of affairs. The Greenwich Lining Conference aptly broke its review of the field down into two broad areas: practice and research, the underlying framework for our discussions here. At the same time, we too will broaden our focus from the more limited topic of lining to include structural conservation, noting that research in this field can be viewed as consisting of both basic research and applied research.

Current Practice

While lining is less frequent now, as evidenced by published surveys and reviews, it is doubtful that paintings have become more stable since 1974. In the intervening years, conservation priorities now

generally seek to preserve original materials when possible, thus resulting in a more minimalist ethic of intervention and different approach to choosing lining as a treatment choice. In addition, mechanical studies of paintings have provided data that can support an alternative range of minimalist approaches. Manipulations of cracked paint films with moisture, the use of heat and pressure without further intervention have been used in various treatments with varying success. Reducing stresses by intervening locally has become common using such methods as repairing tears with reweaving and using yarns to create bridges at tears or point of weakness. The application of local patches is still sometimes used to reinforce the canvas at points of damage and strip linings are commonly applied to reinforce or replace missing tacking margins as they are considered to be less invasive than a full lining.

Supports

Current research has yielded a very good understanding of the changing physical properties of canvases, linen, cotton duck and modern synthetic artist canvas. The incorporation of new materials for many of these tasks, such as synthetic fabrics including polyester and more recently carbon fiber coated polyamide, have also been prompted by the same body of research. Despite these changes in practice, the research does not yet guide us as to which are the best methods to stabilize the overall structure and how to determine the required stiffness and strength for particular situations. Nor has the profession reached consensus with regards to how the data can be interpreted, thus resulting in much debate about the criteria for deciding to make treatment decisions.

Paint

Similarly, basic research has yielded good generic data for single paint layers in different media and how pigments can modify media, but our understanding is not comprehensive across a wide range of environmental conditions or for naturally aged and degraded paints. The same is also true for adhesives, varnishes and some other coatings where good data exists about their chemistry but there is less comprehensive data on their mechanical behavior. Significantly, there is insufficient data on complex mixtures and the interlaminar behavior of canvas paintings, pointing to a need to develop further research techniques for such studies.

Auxiliary Supports

The mechanical model of paintings has also informed applied research in an effort to understand how to reduce overall strain in developing stretchers that move with the painting itself, thereby allowing a painting to maintain relatively constant size and thus lowering the level of strain. How well such techniques, either local or global, improve the long term structural integrity of the painting has yet to be fully studied.

Adhesives for Treatment

The choice of adhesive for whatever structural treatment is undertaken is (of course) crucial. As noted earlier, lining treatments are less frequently employed and “traditional” linings using glue-paste and wax-resin adhesives are now used less often. Glue paste lining has been used in Italy ever since canvas paintings started to deteriorate and needed reinforcement. There are many regional variations on the materials and techniques. Glue paste lining was most prevalent in the 18th C and 19th C although even then, some of the drawbacks of this technique were recognized and this led to alternatives such as wax based treatments. Wax-resin lining was first used in the early 19th century in the Netherlands,

introduced into the UK in the 20th, and shortly thereafter adopted widely in the U.S. These lining methods both consolidated the overall structure and simultaneously adhered the lining canvas to the original. Debates have been vocal and volatile as to how effectively these linings provide overall consolidation in addition to how frequently and extensively they result in color change on the lined painting. In recent decades conservators have turned to BEVA (in its various formulations) and it is now a very common lining adhesive and consolidant. Other synthetic adhesives, including Plextol 500, are also in use today as well as solvent activated linings using acrylic co-polymer adhesives. It is important to note that such treatments add further complexity in considering questions about long term mechanical stability while introducing other critical questions such as possible change in appearance.

Evaluation of the mechanical properties and environmental response of lined paintings is sparse and somewhat contradictory. There are good studies on the color changes induced in wax lining, and descriptions of alternative methods and adhesives that do not introduce such changes. Epidemiological studies of collections are now becoming more common for providing us with valuable data on cultural heritage. Not only could such studies for paintings help us to evaluate what has been lost and gained by lining and flattening treatments, but (as always) we can learn from our mistakes. Additionally, epidemiological studies can help establish whether regional/national trends in lining practice are based on the type of paintings encountered in those regions or some other criteria.

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> "Epidemiology studies the distribution of a disease or a specific adverse condition in a defined population. Applied to cultural heritage, epidemiological methods can be used investigate the causal relationships between mechanical damage in objects and their environment. For instance, this approach has been used in the GCI Managing Collection Environments Initiative." (Druzik and Boersma, 2017)

Druznik, J., and F. Boersma. 2017. Epidemiology: Basic Ideas Applied to Museum Collections. *A Report from an Experts Meeting Organized by the Getty Conservation Institute, June 15–16, 2015*. Los Angeles: The Getty Conservation Institute.
http://www.getty.edu/conservation/publications_resources/pdf_publications/epidemiology.html
Box end

Preventive Methods

Preventive methods are another manifestation of the minimalist approach to the problems discussed in this brief article. Solutions for mitigating structural change include loose linings, the use of backboards, and glazing the painting in its frame as some of the more common methods of buffering the work from changing environmental conditions. Such steps have been shown to be effective but other issues such as fogging on the inside of the glazing and the possible build up of VOC's raise questions about whether these preventive measures can be better implemented or even whether newer methods can be developed to further mitigate the need for structural treatments.

What Next?

Since the Greenwich Lining Conference, a distinction between older paintings on canvas and those that would be categorized as modern and contemporary has introduced new questions about appropriate

intervention on materials that are still ageing and changing relatively rapidly. The paint/material surfaces of contemporary works can preclude treatment methods involving heat and moisture. This raises the question(s) of whether these younger works require a different practical theory of structural intervention: what specific issues are encountered with modern and contemporary works? Do we have, and should we have, the same value judgments for contemporary paintings and what we hope to achieve through treatments?

While a wide range of adhesives is used in structural conservation treatments, each is favored by conservators for an almost equally wide range of reasons. This points to the critical need to make sense of what we see and feel during treatments and to value our empirical experience alongside scientific research. For instance, conservators often refer to BEVA as having good working properties and being strong, and thus it has found broad adoption as not just a lining adhesive but also as a general consolidant. This is a critical example of the subjective characterization in practice e.g. BEVA is strong only relative to something else that is less strong. What criteria do we use in evaluating what we require from an adhesive - do we want it to be strong or weak, elastic or inelastic, ductile or brittle? It is all relative and dependent on the particular materials and planned treatment for the painting? What data and/or theory do conservators use to make these judgments? When we modify by diluting or mixing together adhesives do they really have the properties we think they have?

Recent decades have seen the introduction of new classes of polymers that may well offer better, more targeted mechanical and working properties and increased longevity. Successful basic research leading to the development of new adhesives requires constant dialog between practitioners and researchers to fully apply results in the field. There is also of course the age old economic challenge for the profession; the market for conservation products is often judged to be too small for a pro-active program of design and manufacture of materials fit for purpose. Can we clarify what purpose, characteristics, and properties we want from specific materials that would be conducive to a manufacturer to invest in their production?

In addition, analytical and state-of-art imaging techniques may tell us more about the composition and chemical degradation of paintings, but we are still very limited in what we can measure about the condition and interlaminar properties of a canvas painting on more than a microscopic scale. As yet, technology can provide only limited data through the layer structure in real time to give us insight into the dynamic mechanics of these composite structures. Progress in this area could also provide critical evidence for evaluating the effectiveness of current practice in stabilizing paintings.

Summary

While our practice in the structural conservation of paintings has been fairly predictable in recent years, the time is ripe to more fully engage with recent research, to develop new research initiatives that can truly validate current practice, and to introduce new, more refined, materials, techniques and theories for these treatments. These efforts arguably could help us re-evaluate crucial concepts and phrases that have entered the profession: are the “behaves like the original” argument or “thou shalt not move” paint layer mantra actually valid? Can we “bring a canvas back to life” by de-lining, and is the painting now more authentic after such a treatment? Can we define fundamental research questions to address gaps in our understanding of the complex layer structure and interactions of a painting? Can we identify and equip paintings conservators with the skills and knowledge needed to make ever more informed decisions for specific structural treatments to conserve canvas paintings? These challenges recognize the

fundamental complexity of studying and treating paintings as the basis for continued progress in our daily practice.

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Further Reading

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Sidebar

"canvas paintings are notoriously difficult to study" (Hendrickx et al. 2017, 393).

"The lack of new developments [in moisture treatment of cracked paint films]…reflects…,perhaps, a pragmatic appreciation of the difficulties of achieving permanent results" (Ackroyd 2002, 11).

"Now that the need is so apparent, surely research topics first suggested thirty, forty or even fifty years ago and since neglected can now be taken up; and with the sophisticated tools now available—institutional, methodological, and intellectual—yield the essential information the conservation profession so urgently needs." (Keyser 1984, 9).